CENTRIFUGE SCIENCE EVALUATION

For the Human Research Facility Refrigerated Centrifuge Unit

PREPARED FOR :
LIFE SCIENCES RESEARCH LABORATORIES/MEDICAL SCIENCES DIVISION
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Centrifuge Science Evaluation -
Mikro 22R Refrigerated Centrifuge Unit

OVERVIEW:

A centrifuge is a mechanical device used to quickly separate substances of different densities that would normally separate slowly under the influence of gravity. The Human Research Facilty (HRF) Refrigerated Centrifuge (RC) is a Class C Facility Payload being built for the HRF. The RC is intended to provide a system of quick separation of biological samples, such as blood and saliva, based on differing sample densities in a controlled temperature environment. The HRF refrigerated centrifuge is based on the Hettich MIKRO 22R model. The commercial unit has been, repackaged into a 12 Panel Unit drawer.

ROTOR TESTS:

Ground-based Testing

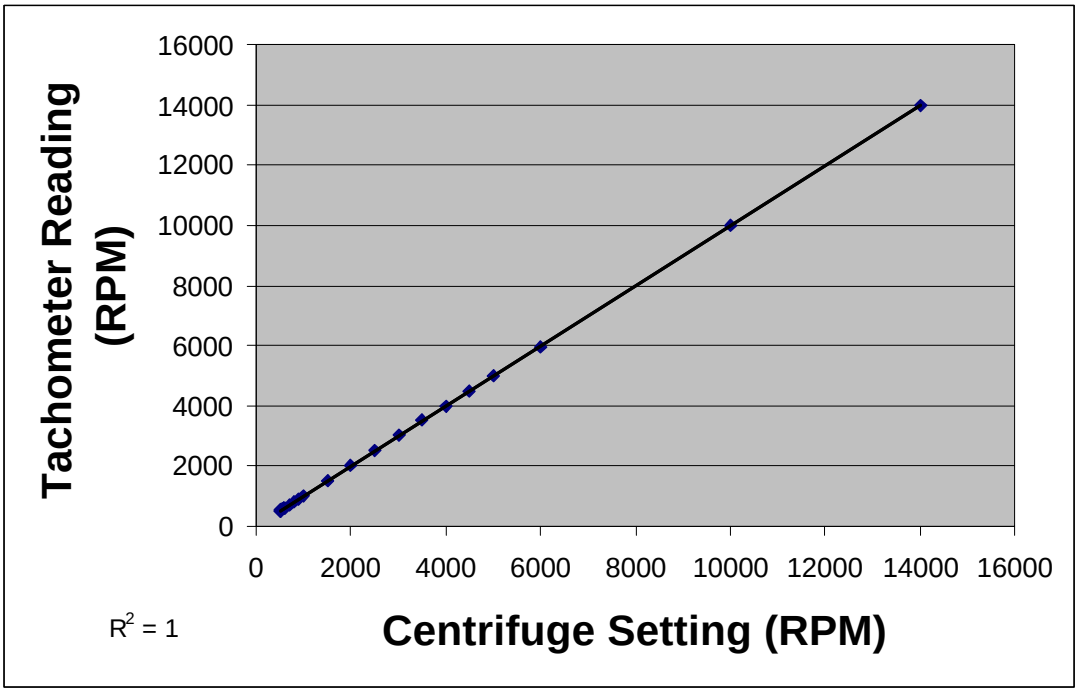
A listing of the rotors and reducers tested is shown in Table 1. All rotors and reducers tested accomodated the number and size of tubes indicated below.

Table 1: Centrifuge Rotors and Reducers

Rotor Number (Max. speed)	Reducer Number	Tube type	Number per rotor
1016 (6000 RPM)	No reducer	50 ml round bottom	6
		50 ml conical bottom	3
	1635	12 ml - blood	6
		15 ml - blood	6
		Saliva tubes	6
	1632	7 ml - blood	18
1020 (5,000 RPM)	No reducer	5 ml - blood	8
1158 (14,000 RPM)	2031	2.2 ml - blood	48
	2031	1.5 ml tube	48
	2023	0.5 ml tube	48

Rotor speed was measured using a digital photo tachometer (Extech Instruments, Model #461893). The rotor speed shown on the instrument was accurate (Figure 1).

Figure 1: Rotor Speed versus Centrifuge Setting



KC-135 Testing

Rotor # 1016 - The 50 ml tubes without adapters would float slightly in the wells but would remain in place long enough to get the centrifuge rotor started. The padding used to adapt the wells helped, but in some cases held the tubes too tightly causing some caps to be pulled off when trying to remove the tubes from the adapters.

Rotor # 1020 - The swing-bucket rotor did not function well during the KC-135 testing. The buckets floated in microgravity making installation and removal difficult and creating a potential for the buckets to float out of place prior to starting the centrifuge. This could cause significant damage if a bucket floated out as the start button was being pressed.

Rotor # 1158 - The adapters were too loose in the rotors and the tubes were too loose in the adapters. This caused the adapters and tubes to float out during installation and removal of the rotor.

Rotor speed on the KC-135 was measured using a digital photo tachometer (Extech Instruments, Model #461893). Due to the limited time on the KC-135,

only a few readings were taken. The results are shown below (Table 2) and are comparable to the ground-based results.

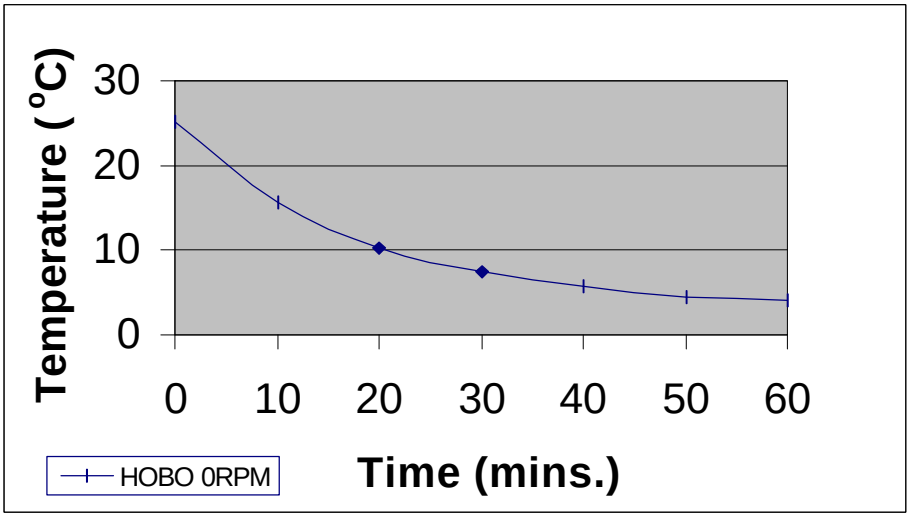
Table 2: KC-135 Tachometer Readings

Rotor #	Display RPM	Tachometer Reading
1020	3,000	3040
1016	3,000	3020
1158	2,400	2430

TEMPERATURE PROFILES:

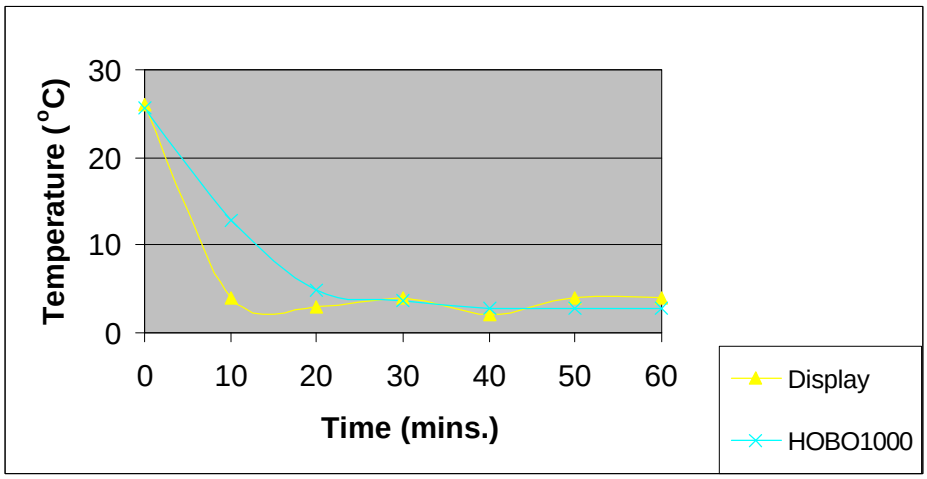
The chamber temperature profile was measured by placing the HOBO™–temp probe in a rotor well and securing the HOBO™–temp to the rotor. The display shows the set temperature when the rotor is stationary and the chamber temperature when the rotor is rotating. The sensor for the display temperature read-out is located along the steel wall of the centrifuge.

Figure 2 : Chamber Temperature Results at 0 RPM



The sample temperature profile was measured by placing the HOBO™–temp probe into a 1.5ml microcentrifuge tube containing saline sample and securing the HOBO™–temp to the rotor. Due to modifications to the compressor for microgravity, only Rotor # 1158 could be operated with the compressor running in the flight configuration, therefore, the 5ml and 7ml blood tubes were not used. The temperature testing was conducted with a temperature setting of 4^0C and rotor speed of 1000 RPM. This test was conducted to compare the display output to the actual sample temperature. The temperature profiles were comparable to the previous evaluation.

Figure 3: Sample Temperature profile at 1000 RPM



TIMING:

Acceleration and braking times were tested to 14,000 RPM using Rotor # 1158 (Figures 4 & 5). Times indicated are the duration of time for the rotor to either reach planned speed, or to stop.

Figure 4 : Acceleration Times

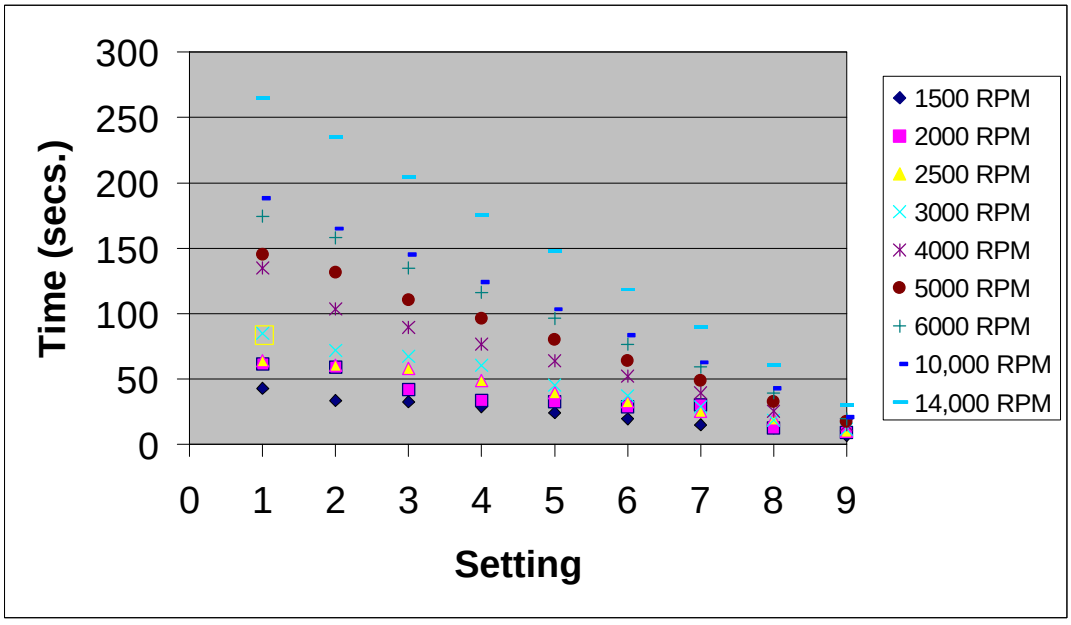
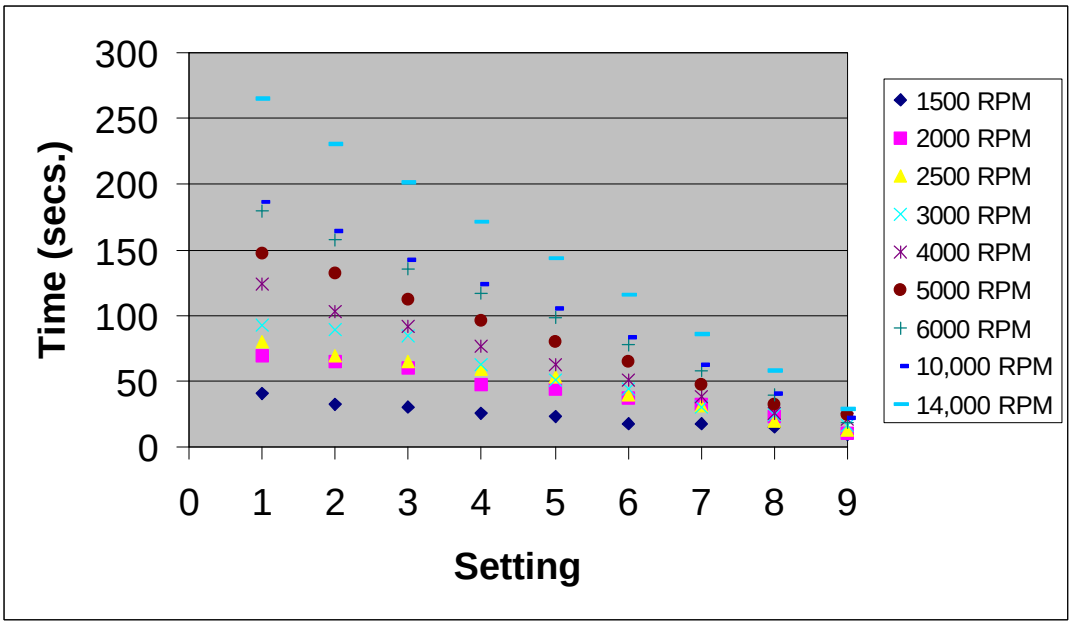


Figure 5 : Braking Times



SUMMARY:

The modified HRF Refrigerated Centrifuge Unit is capable of maintaining and displaying variable temperature and RPM speeds. Samples were adequately cooled during centrifugation. The Centrifuge temperature, time, and RPM/RCF settings are programmable. Acceleration and braking can be adjusted as needed for sample protocols. The adapters need to be modified to improve use and performance in microgravity. Constructing adapters to hold the smaller tubes (5 ml) will eliminate the need for Rotor# 1020, the swing-bucket rotor. With the modifications noted above, the modified HRF Refrigerated Centrifuge Unit meets the science requirements.